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INSOMNIA AND RECENT HYPNOTICS.

BY WILLIAM A. HAMMOND, M. D., SURGEON-GENERAL U. S. ARMY (RETIRED).

THERE is no more prevalent condition of mental derangement than the inability to sleep. The state of excitement in which people of the present day live, the demands of business, the struggle for wealth and position, all of which were never so great as in our own time, produce just that state of the brain which, if continued not only through the day but far into the night, makes sound and healthy sleep an impossibility.

I am aware that the mere assertion of this fact will not carry half as much weight to the mind of the educated layman as will a few words explaining what sleep is and in what its opposite condition, wakefulness, consists, and I therefore propose, before touching upon the subject of recently discovered sleep-producers, to make their action intelligible by describing briefly what they have to do and how they do it.

Observations made of those persons whom accident or disease has rendered fit subjects for investigation, and experiments conducted with all necessary precautions to insure accuracy, show beyond doubt that sleep is the result of a diminution of the quantity of blood circulating through the brain. Thus Blumenbach, nearly seventy years ago, detailed the case of a young man eighteen years of age who had fallen from a height and fractured his skull, losing a large portion of the bone. After recovery took place a depression remained, covered only by the scalp. While the young man was awake this chasm was quite superficial, but as soon as sleep ensued it became very deep. The change was evidently due to the fact that during sleep the brain was in a collapsed condition from a diminished amount of blood in the cerebral vessels, while when awake the quantity was increased and the scalp correspondingly elevated.

Again in 1821 a woman in Montpelier, France, lost part of her skull by a severe accident and the brain and its membranes lay bare. When she was in deep sleep the organ remained motionless beneath the crest of the cranial bones. When she was dreaming it became somewhat elevated and when she was awake it protruded from the fissure in the skull.

It is a well-known fact that in young infants there are two openings in the cranium so that at those places the brain and its membranes are only covered by the scalp. Observation shows us that when these infants are awake the integument is raised considerably above the level of the skull, while when asleep it is correspondingly depressed.

Experiments performed for the express purpose of ascertaining the cause of sleep, confirm the results deduced from the observations cited.

Mr. Durham, a distinguished English surgeon, some thirty years ago trephined the skull of a dog and observed when the brain was exposed to view, that its surface, while the animal was asleep, became pale and sank below the level of the bone; the veins ceased to be distended and many which had been full of dark blood could no longer be perceived. When the animal was roused the surface of the brain became suffused with a red blush and it ascended to the opening through the skull. As the mental excitement increased the brain became more and more turgid with blood and innumerable vessels sprang into sight. After being fed the animal fell asleep and the brain again became contracted and pale. In all these observations the contrast between the two conditions was exceedingly well marked.

Several years ago I became greatly interested in the subject of sleep and its derangements, and from many observations and experiments the conclusion was irresistibly reached that sleep is directly the result of a diminished amount of blood flowing through the brain.

In 1854, when, as a medical officer of the army, I was stationed at Fort Riley, in Kansas, a man came under my notice who had, through a frightful railway accident, lost about eighteen square inches of his skull. There was thus a fissure of his cranium three inches wide and six inches long. The man, who was employed as a wood-chopper, was subject to severe and frequent epileptic fits, during which I often attended him. When he was awake the region of scalp in question was always nearly on a level with the upper surface of the cranial bones. In the act of going to sleep it gradually sank until it was more than half an inch lower than it had previously been. At the very instant of awaking the scalp rose to its usual height.

Many experiments which I have performed upon animals lead to results identical with those obtained by Durham, and by means of an instrument screwed into an opening in the skull, and acting in a manner similar to that of a barometer, the intra-cranial pressure can be accurately measured. By this instrument it is shown that during sleep the liquid falls in the tube, while when wakefulness is present, the liquid rises. During the first-named condition, therefore, the pressure is lessened, and this can only be due to a diminution in the quantity of blood in the brain. During the second-named condition the pressure is increased, and this can only result from an augmentation in the volume of the cerebral blood.

There are a great many other reasons that could be brought forward in support of this theory, but the foregoing are sufficient to establish the point. The *immediate* cause of sleep, therefore, is a diminution of the quantity of blood circulating in the vessels of the brain. The *exciting* cause of periodical and natural sleep is the necessity which exists that the loss of substance which the brain has undergone during its state of greatest activity should be restored. To use the simile of the steam engine, the fires are lowered and the operators go to work to repair damages and put the machine in order for the next day's work.

From all this, we know that whatever increases the amount of blood in the brain tends to produce wakefulness, and that whatever lessens the quantity is productive of sleep.

Now, it happens in this stirring age of ours that men—and women too—are worked so much intellectually, or are so emotionally disturbed, that their brains have more to do than they can accomplish, and yet preserve their normal balance. Mental work, whether it be simply perceptional, intellectual, emotional or volitional, requires that an increased amount of blood shall flow to the brain; hence, during mental exertion of any kind, the cerebral vessels become distended owing to the increased volume of blood they contain, and they remain in this condition as long as the exertion is continued. If it be too intense, or if it be persevered in for too long a period without adequate alternations of rest, the vessels lose their contractibility, and remain in a permanently enlarged state. They are, therefore, not able to contract so as to produce sleep. A state of cerebral congestion is established, and wakefulness is the result.

Such persons go to bed, perhaps, feeling as if they would sleep, but no sooner do their heads touch their pillows than their minds become inordinately active and they lie awake hour after hour recalling the events of the day or else indulging in the most preposterous thoughts. The blood-vessels will not empty themselves simply because they have lost the power to do so. They are like the India-rubber bands that we put around big packages and leave undisturbed for a long time. We try to use them again and we find that the elasticity, which they once possessed, has gone.

As wakefulness is therefore the result of an undue amount of blood flowing through the brain it follows that those agents, whether they be hygienic or strictly medical, that lessen the quantity, will cause sleep. There are many substances known to both physicians and laymen that accomplish this object, but in what I shall have to say on the subject of hypnotics, I shall limit myself to those medicines which are synthetical, that is, formed in the laboratory by the union of other substances of altogether different chemical and therapeutical properties. Some of these are made from coal-tar, that wonderful body to which we owe acetanilide or antifebrine, the so-called antipyrine and many other powerful remedies. All are organic but none of them, like morphine, strychnine, hyoscyamine, and hundreds of other active principles, exists, in a state of nature as a constituent of plants.

And, it is to be borne in mind by the reader, that I am writing simply to give him information in regard to an exceedingly interesting and important subject, a mere smattering, as it were, and not sufficient, even if he were possessed of a medical education, to enable him to use any one of the substances brought to his notice. Every well-educated person ought to have a general knowledge of medical science, and of the means and processes used by physicians and surgeons in the management of the diseases and injuries to which mankind is subject. But this no more qualifies him to use these means and processes himself than reading a work on popular astronomy would fit him to be the director of the Naval Observatory. He would be fully as likely to do as much injury in the one case as in the other. He would be working on his own body, and hence much more to his disadvantage than if he were endeavoring to compute the orbits of comets or the periods of the rotation of the moons of Jupiter. No one of the substances that I am going to mention can be used, even by the physician, without his first obtaining a thorough knowledge of the constitution of his patient and of the disease he has to treat.

Paraldehyde.—Paraldehyde is a liquid possessing a strong odor of ether and a burning, followed by a cooling, taste, something like that of peppermint. It is of about the density of water, but its boiling point is much higher, being 255° F. At 50° F. it becomes solid. On account of its strong burning taste it is rarely administered in a pure form, being generally given in an emulsion, with mucilage or almond oil. It is particularly valuable as a hypnotic, owing to the fact that it does not tend to weaken the heart. A teaspoonful produces sleep in from five to fifteen minutes, and it is especially useful in those forms of insomnia which are accompanied by much mental excitement, such as we sometimes witness in the insane. A single dose of it can be detected in the breath twenty-four hours afterwards. It rarely if ever produces any gastric derangement and is rapidly absorbed by the stomach. In proper cases it is one of the most valuable of all the hypnotics, but though it has been ten years before the profession, it has scarcely passed beyond the knowledge of neurologists.

Amylene Hydrate.—This substance is one of the alcohols, is a fluid, colorless, with a strong affinity for water and with an odor and taste similar to that of camphor and peppermint. It readily mixes with water and alcohol. The dose as a hypnotic is from forty-five to sixty minims, but it is not very certain in its action, as it frequently produces mental excitement and wakefulness instead of sleep. It is, however, comparatively safe as it has no marked depressing effect on the respiratory or circulatory organs.

Methylal.—This substance, in its most obvious physical characteristics, strongly resembles paraldehyde, but it is of lower specific gravity and very much lower boiling point, this being only 107.6° F. Methylal, when administered internally, first causes a slight degree of excitement, which is generally followed by sound, refreshing sleep. Owing to the fact that it is rapidly eliminated from the lungs its effects are not very permanent, but this difficulty can be overcome by repeating the dose as often as occasion requires. I have very little personal experience with methylal, as I have not been able to discover that it has any advantages over paraldehyde, while it is quite as disagreeable to the taste. It is said to be particularly beneficial in causing sleep in cases of *delirium tremens,* but I think this assertion is to be doubted.

Hypnone.—Hypnone is a colorless liquid with a sharp taste and a peculiar odor. It is somewhat heavier than water. It is not much used in medicine and the dose has to be constantly increased in order to obtain decided effects. It must be given with care, for it weakens the action of the heart and depresses the respiratory power, acting in this respect like chloral and chloroform. The dose is only two or three drops.

Sulphonal.—Although only introduced into medical use three years ago, sulphonal has become widely known and employed as a hypnotic. It occurs in prismatic crystals possessing neither smell nor color and being nearly tasteless. In proper doses, it produces sound and refreshing sleep, but it requires from two to four hours to act. Sulphonal was, at first, asserted to be a perfectly safe medicine. It was said to be free from exercising a depressing effect upon the heart and to be without deleterious influence on the respiratory or digestive organs. Continued experience, however, shows that its administration is not unattended with danger and several deaths from its use have been reported. It seems to have gotten extensively into the hands of the laity, many persons being in the habit of taking it on their own responsibility in order to secure sleep. I have witnessed several cases in which intense cardiac weakness, stupor, and even convulsions have been induced by its use. In one of these cases the patient was in the habit of taking several large doses in the course of the night in order to obtain sleep and generally with an unsuccessful result, for the consequences were frequently intense mental excitement, approaching acute mania in its intensity; twitchings of the arms and legs uncontrollable by the will, severe headache, dimness of sight and upon one occasion double vision. These symptoms did not pass off until late in the afternoon. He was on the verge of acquiring a sulphonal habit when he came under my observation.

Sulphonal is one of those substances, the quantity of which requires to be increased from time to time in order that the desired effect may be produced and hence the danger which attends upon its continued administration. Moreover, like chloral—which substance I shall presently consider—its effect appears to depend, to a great extent, on the state of the patient's system at the time it is taken, and hence a dose that may be perfectly safe and beneficial at one time may cause very unpleasant effects at another.

It is scarcely possible to pick up a medical journal without finding the report of one or more cases in which sulphonal carelessly given or taken has been followed by alarming consequences or even by death itself. One reason why it has become such a favorite with persons who take the responsbility of being their own physicians, is the fact of its comparative freedom from taste and odor. But this slight advantage is more than counterbalanced by other qualities not so pleasant, but of much greater importance.

Chloralamid.—Chloralamid is one of the most recent hypnotics, and, judging by our experience up to this time, one of the most useful. It has a slightly bitter taste, and is not readily soluble in water, but it is promptly dissolved in alcohol. It appears to have no injurious action on the heart or respiration. The sleep that it produces is refreshing, and not so profound but that the subject wakes once or twice in the course of the night for a moment or two. It seems to be a pure hypnotic, no other marked effect upon the organs of the body besides the brain having as yet been observed. It simply contracts the cerebral blood-vessels, diminishing the amount of blood circulating in the substance of the brain and thus producing sleep. It begins to act within half an hour. It is a hypnotic even in the cases of those persons who are the subjects of acute pain, and would, therefore, otherwise pass the night in great discomfort.

It is likewise useful when capital operations have been performed and when sleep is so necessary for the organism. In the cases of persons suffering from nervous prostration or insanity, and in whom want of sleep is the prime cause of the nervous exhaustion they so frequently exhibit, chloralamid, when properly administered, is a remedy of inestimable value. Undoubtedly, however, the fact that no cases of its unpleasant results have yet been reported is due to the fact of its having been so short a while before the profession. As soon as the people get hold of it we shall surely have an experience of its effects very different from that which we now possess.

Urethrane.—This substance is not extensively employed in medicine although it has been in use since 1885. It exists in colorless crystals, is odorless, and has a taste somewhat like that of salt-petre. It is dissolved readily in water and alcohol. It produces a quiet natural sleep, not followed by any unpleasant results. It is, however, uncertain in its action and hence cannot be relied upon when sleep is imperatively demanded. Nevertheless, I have occasionally seen it succeed when sulphonal and even chloral had failed.

Chloral.—Chloral was first made by Liebig, in 1832, by the action of chlorine on alcohol. Hence the name, consisting of the two first syllables of the words used to designate those substances. Although it has been known for over sixty years, it was only in 1869 that Liebreich introduced it into medical use. It at once took a prominent place among the hypnotics, and has perhaps been more used and more abused than all the rest of the recently discovered sleep-producers combined. It is employed in medicine in the form of a hydrate. As such, it is a white crystallized substance readily absorbing moisture from the atmosphere, and soluble in water or alcohol. It has a somewhat sharp taste and an odor slightly resembling that of chloroform. Chloral has a good many therapeutical applications, but it is only as a hypnotic that I shall here consider it.

The sleep produced by choral is natural in almost every respect. Its first effect when taken in a sleep-producing dose is a slight feeling of exhilaration which is soon followed by a sensation of *bien aise,* which gradually passes into somnolence. The duration of the sleep varies in accordance with the dose, and at its termination there is rarely headache or derangement of the digestive system. Experiments which I have performed with reference to the hypnotic effect of chloral show that it produces a true cerebral anæmia, and hence its power as a hypnotic.

Although small doses of chloral can generally be taken with safety, a large quantity acts as a poison to the heart, paralyzing this organ and therefore causing death. It likewise diminishes the excitability of the respiratory nerve centres and causes a rapid and marked fall in the temperature of the body.

Now there is one fact connected with the physiological action of chloral which is almost sufficient of itself to place it outside of the domain of therapeutics, and that is, the uncertainty, depending upon the individual to whom it is given, as to what constitutes a proper dose; and this as regards not only different persons but the same person at different times. Thus a dose that at one time may produce sound and healthy sleep, without any ill consequences, may, at another time, cause many serious symptoms and even death.

I well remember the case of a lady whom I saw, in consultation with a young physician, in New York, soon after chloral was introduced to the profession, and whom, as she was afflicted with insomnia, I advised to take twenty-five grains of it. She took the dose, and, as I was informed the next day by her physician, with the happiest results. The wakefulness proved to be at that time of a temporary character, but about a year subsequently it returned, and her physician recalling to mind the good results of the twenty-five grains of chloral she had taken a year previously, repeated the dose. She at once passed into a condition of stupor from which she could not be aroused, and in less than two hours her heart had ceased to beat. I arrived at the house just in time to see her breathe her last. I have never given chloral since that day.

Liebreich's explanation of this uncertainty in the action of chloral is, that it is decomposed by the alkalinity of the blood and chloroform is set free. When the blood is slightly alkaline, the decomposition takes place slowly and sleep without unpleasant results follows, but when this fluid is strongly alkaline, decomposition ensues with great rapidity and the resulting chloroform poisons the heart.

The deaths from chloral have been very numerous, most of them occurring in persons who have been taking it on their own responsibility. As there are no means of knowing the state of the blood as regards its degree of alkalinity, the practice of taking chloral to produce sleep cannot be too severely condemned; and while I would not, perhaps, go so far as to say that it should never under any circumstances be employed in medicine, I am very sure that even with the utmost watchfulness and care on the part of the physician its use is not unattended with danger.

There is a chloral habit and hence we have a condition known as chloralism. This is probably the most deplorable of all those vices which a desire for stimulants and sedatives, for excitement and oblivion, has fastened upon our civilization; but its consider ation does not fall within the scope of the present discussion.

WILLIAM A. HAMMOND